OPTIMIZATION OF AGRICULTURAL LAND IN CHERKASY REGION THROUGH ALTERNATIVE FARMING SYSTEMS

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Abstract. *In recent years, much attention has been paid to preserving soil fertility and preventing soil degradation, driven by public interest in the environment and growing awareness of the role of soil cover in ensuring environmental and food security in any country. A negative consequence of anthropogenic impact is the deterioration of the ecological function of soils in the ecosystem. There are processes of compaction and disruption of water, air and nutrient regimes. The goal of article is to soil erosion is the main destabilizing factor of the ecological situation in the agricultural landscapes of Cherkasy region, and this publication is aimed at studying it. To determine the qualitative characteristic of the soil cover, namely the actual state of water erosion, the erodibility coefficient (CEr) and data on the distribution of eroded soils by gradations of erodibility are used. The soil erosion coefficient is calculated as a weighted average for each soil based on the coefficients (non-eroded - 1; slightly eroded - 1.2; medium eroded - 1.4; highly eroded - 1.6), which indicate a corresponding decrease in fertility compared to the full profile soil. The erodibility coefficient, together with the data on the distribution of eroded soils by gradations of erodibility, is used as an important qualitative characteristic of the soil cover. Agricultural land occupies about 70% of Ukraine's territory, which is more than 60 million hectares. Overdevelopment of agriculture and a large amount of arable land are the main environmental problems associated with agriculture. The average plowed area reaches 70%, and 90% in Vinnytsia, Cherkasy, Kherson, Kirovohrad, and Zaporizhzhia regions. The article describes the negative effects of water erosion on agricultural landscapes of Cherkasy region. The definition of the qualitative characteristics of the soil cover, namely the actual state of erosion processes using the erodibility coefficient, is given.*

Keywords: *erosion, washed away soils, anti-erosion measures, organic farming.*

JEL Classification H56; Q24

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Introduction. Ukraine has entered a new stage of socio-economic development, characterized by the growing role of market mechanisms for regulating economic activity, primarily in non-agricultural sectors. The country has generally established the foundations of a market-based land system: the state's monopoly on land has been eliminated, a transition to a multi-faceted land use system has been made, and land use fees have been introduced. According to the law, land has become an object of real estate and civil relations. However, due to the ineffective land policy of the state, the problem of organizing the rational use and protection of land is becoming more acute. Market transformations of land relations have become protracted. A significant number of them are not systematic, formal, costly, and without proper scientific justification.

As a result, most of the issues of "entering the market" are solved by trial and error. The land reform has started and is almost completed in the absence of a land transformation program, without defining socio-economic and environmental goals, foreseeing consequences, and ensuring appropriate legislative, financial, institutional, human resources, political, moral and psychological preconditions.

The shortcomings of the land policy, haste and lack of consideration in the land reform have had the most negative impact on the Ukrainian countryside and the domestic agricultural sector. The problems that have arisen here as a result of a hasty, unprepared land reform require a separate discussion.

The current state of affairs in the field of land relations requires a decisive revision of land policy and the development of a new national strategy for the development of the land use system, in which the role of the state should be significantly strengthened. The state authorities should create conditions and actively promote the process of forming socially and environmentally oriented regional land use models.

Ukraine is facing a difficult task of creating a land use system that would combine free land ownership and social justice in land use. As for the international experience of organizing land use, the approach to it should be very critical and balanced. First of all, it should be borne in mind that in most countries of the world there has never been and cannot be free unregulated land turnover.

Environmentally sound land use is a prerequisite for the sustainable development of the agricultural sector and society as a whole. The current critical state of land resources in Ukraine, including in the Uman region, the deterioration of the ecological condition of intensively used agricultural land, the decline in soil fertility and the spread of soil degradation require significant changes in human economic activity and environmental management.

Literature review. The problems of land policy development in Ukraine are studied in the works of such national scholars as: D.S. Dobriak, L.Y. Novakovsky, P.T. Sabluk, V.M. Trehubchuk, A.M. Tretiak, M.A. Khvesyk and others. However, the present requires further research in this area, taking into account the changes that have occurred in the development of land relations. At the same time, further transformation of the national land use system should be based on balancing the set of fundamental principles of formation of market land relations.

The problem of the development and spread of degradation processes in Ukraine has been studied by such scholars as: Medvedev V.V., Laktionova T.M., Shykula N.K., Tararyko O.G. and others.

The steady decline in soil fertility is a cause for acute concern. There are serious problems with replenishing the bioenergy potential of soils. The total loss of humus due to mineralization (oxidative destruction) and soil erosion annually amounts to 32-33 million tons, which is equivalent to 320-330 million tons of organic fertilizers, and environmental and economic losses due to erosion exceed UAH 9.1 billion. The decline in land fertility and land reclamation, the huge scale and intensity of soil degradation result in an annual shortfall of 10-12 million tons of agricultural products in terms of grain [1].

A negative environmental consequence of Ukraine's land reform was the parceling out of a significant portion of unproductive and degraded land, including eroded land.

Annual plowing and loosening of soils, disruption of the structure of crop areas and crop rotations, destruction of grass and forest vegetation on steep slopes leads to intensive development of erosion processes.

Water and wind erosion, repeated cultivation with powerful heavy machinery, disturbance of soil structure and insufficient fertilization of crops are the main reasons for the deterioration of soil agronomic properties. Erosion affects 57.5% of Ukrainian soils, of which about 1.7 million hectares (4.1%) of agricultural land is affected by wind erosion, 13.3 million hectares (32%) by water erosion, and more than 2 million hectares (4.8%) by a combination of water and wind erosion.

Both water and wind erosion or deflation occur on the territory of Cherkasy region.

The development of water erosion is closely related to the terrain. An increase in slope steepness leads to an increase in flow velocity and intensity of soil washout. It has been established that soil destruction begins at a slope steepness of more than 1-2. The constant use of such lands in field crop rotations without the use of erosion control measures leads to intensive soil washout.

Wind erosion occurs mainly in areas of unstable moisture. The consequences of wind erosion are the removal of fertile fine soil from the surface soil layer, significant losses of humus and nutrients, and a decrease in fertility.

Aims. The goal of article is to soil erosion is the main destabilizing factor of the ecological situation in the agricultural landscapes of Cherkasy region, and this publication is aimed at studying it.

Methodology. To determine the qualitative characteristic of the soil cover, namely the actual state of water erosion, the erodibility coefficient (CEr) and data on the distribution of eroded soils by gradations of erodibility are used. The soil erosion coefficient is calculated as a weighted average for each soil based on the coefficients (non-eroded - 1; slightly eroded - 1.2; medium eroded - 1.4; highly eroded - 1.6), which indicate a corresponding decrease in fertility compared to the full profile soil. The erodibility coefficient, together with the data on the distribution of eroded soils by

gradations of erodibility, is used as an important qualitative characteristic of the soil cover [2].

Results. A significant part of the region's territory is prone to erosion processes, which causes the presence of 294.3 thousand hectares (26%) of washed away soils in arable land: heavily washed away - 23 thousand hectares (2.1%), medium washed away - 69.1 thousand hectares (6.2%), and lightly washed away - 202.2 thousand hectares (18.1%) (Table 1).

Table 1. The area of washed away soils in Cherkasy region

Administrative district	Washed away soils							
	Total, thousand hectares	%	Including.					
			weakly	%	average	%	strongly	%
Gorodishchensky	21,1	48,6	12,9	29,7	5,3	12,3	2,8	6,5
Drabivskyi	3,6	4,2	3,3	3,8	0,2	0,3	0,07	0,08
Zhashkivskyi	16,5	23,6	12,7	18,1	3,2	4,6	0,6	0,9
Zvenigorodsky	19,4	36,8	12,5	23,7	5,1	9,8	1,7	3,3
Zolotonosha	6,2	8,2	4,9	6,7	0,8	1,1	0,4	0,5
Kamensky	14,6	38,2	12,3	32,6	2,1	5,6	0,1	0,3
Kanevsky	17,8	41,3	11,5	26,5	4,1	9,5	2,2	5,1
Katerynopilskyi	14,8	32,6	10,3	22,7	3,5	7,8	0,9	2,0
Korsun-Shevchenkovsky	23,4	56,6	13,9	33,7	6,1	14,8	3,3	8,0
Lysyansky	18,6	40,2	11,6	25,1	4,9	10,5	2,0	4,4
Mankivskyi	14,4	28,8	10,5	21,1	3,3	6,6	0,5	1,0
Monastyryshchenskyi	13,7	28,9	8,7	18,3	4,1	8,7	0,8	1,8
Smelyansky	17,2	39,7	10,5	24,2	4,4	10,3	2,2	5,1
Talnivsky	16,3	29,3	13,9	22,3	3,8	6,2	0,4	0,7
Umansky	19,2	20,8	15,0	16,2	3,4	3,6	0,8	0,8
Khrystynivskyi	5,7	13,0	4,4	10,2	1,0	2,4	0,2	0,4
Cherkasy	3,9	10,6	2,2	6,2	0,9	2,6	0,6	1,7
Chigirinsky	16,5	43,0	9,4	24,6	5,6	14,6	3,4	3,7
Chernobayevsky	5,1	5,8	4,1	4,7	0,4	0,5	0,5	0,6
Shpolyansky	23,6	33,7	16,8	24,0	5,9	8,4	0,8	1,2
Cherkasy region	**294,3**	**26,4**	**202,2**	**18,1**	**69,1**	**6,2**	**22,9**	**2,1**

Source: developed by author

The table shows that the most difficult situation is observed on the territory of districts with a narrow-wavy type of relief, especially in Kaniv and Korsun-Shevchenkivsky districts, which are located near the Dnipro River. More than half, namely 56.6% of the arable land area of Korsun-Shevchenkivskyi district is subject to water erosion, of which 33.7% are slightly washed away, 14.8% are medium washed away, and 8% are highly washed away. Large areas of washed away soils are also observed in Horodyshchenskyi 21.1 thousand hectares (48.6%), Kanivskyi 17.8 thousand hectares (41.3%), Chyhyrynskyi 16.5 thousand hectares (43%), and Lysianskyi 18.6 thousand hectares (40.2%) districts. In terms of the degree of leaching, we note heavily leached areas in Korsun-Shevchenkivskyi (8%), Horodyshchenskyi (6.5%), Kanivskyi and Smilianskyi (5.1%) districts.

To characterize the manifestation of water erosion, we use the erodibility coefficient (CE**r**) (Table 2).

Table 2. Determination of the erodibility coefficient (CEr**) of the soil cover of Cherkasy region**

Administrative district	CEr	Degree of development of water-erosion processes
Gorodishchensky	1,09	Satisfactory
Drabivskyi	1,01	Normal
Zhashkivskyi	1,04	Normal
Zvenigorodsky	1,07	Satisfactory
Zolotonosha	1,02	Normal
Kamensky	1,06	Satisfactory
Kanevsky	1,08	Satisfactory
Katerynopilskyi	1,06	Satisfactory
Korsun-Shevchenkovsky	1,11	Pre-crisis
Lysyansky	1,08	Satisfactory
Mankivskyi	1,05	Normal
Monastyryshchenskyi	1,06	Satisfactory
Smelyansky	1,06	Satisfactory
Talnivsky	1,05	Normal
Umansky	1,04	Normal
Khrystynivskyi	1,03	Normal
Cherkasy	1,03	Normal
Chigirinsky	1,2	Crisis
Chernobayevsky	1,01	Normal
Shpolyansky	1,06	Satisfactory
Cherkasy region	**1,05**	**Normal**

Source: developed by author

Analyzing the data in the table, we can see that, according to the normal development of water-erosion processes, actual erosion does not significantly affect soil fertility, i.e., CE**r** < 1.05. The rate of average annual erosion loss for sod-podzolic soils is 2.2-2.4, and for chernozem soils - 2.6-4.5 t/ha. Normal manifestation of water-erosion processes is characterized by arable land in most districts of Cherkasy region, namely: Drabiv, Zhashkiv, Talniv, Uman, etc. Land resources are used and crops are grown without additional erosion control measures.

A satisfactory degree of development is characterized by annual erosion losses of soil that are 1.5-3 times higher than the norm, and the erodibility coefficient ranges from 1.05<C<1.10. Such indicators are concentrated in Horodyshchenskyi, Kanivskyi, Lysianskyi, Zvenyhorodskyi and several other districts. The organization of land use requires a critical review of land use technologies in the direction of reducing anthropogenic load by reducing arable land and minimizing technologies.

The pre-crisis manifestation of the development of water-erosion processes is characterized by annual erosion losses that exceed the norm by 3-5 times, while the erodibility coefficient ranges from 1.11 to C to 1.15, and this phenomenon is observed in the Korsun-Shevchenkivskyi district. The use of conventional erosion control measures is not enough, so it is necessary to develop a special agro-landscape erosion control system.

In the case of crisis development of eroded processes, soil losses exceed the norm by 5-7 times, and the erodibility coefficient varies between 1.15< C <1.20. In the Cherkasy region, such data correspond to only one Chyhyryn district, where it is necessary to reduce the area of arable land and to reforest heavily degraded and unproductive lands.

No territories where the intensity of water erosion is assessed as catastrophic have been identified within Cherkasy Oblast.

Discussion. Erosion processes are progressing as a result of the cessation of soil protection farming with contour reclamation, reduced use of organic fertilizers, and unreasonable plowing of agricultural landscapes. One way out of this difficult situation is to switch to alternative farming methods. Organic farming can be attributed to such systems of agricultural production, which, in addition to obtaining environmentally friendly products, also involves: minimizing tillage and introducing wide-coverage tillage and sowing tools; applying contour organization of the land use territory; bringing to optimal field protection and water protection forest cover; restoring a unified system of field protection forest belts as the most important means of stabilizing agricultural landscapes and fixing field boundaries [3].

An important role in organic production technologies is played by certain technological methods, in particular, the selection of new varieties of intensive and semi-intensive type, which have genetically determined adaptive potential and maximum adaptability to specific zonal conditions, and which most fully reveal the genetic potential of productivity when using organic cultivation technologies [4].

Organic production involves the prohibition of synthetic fertilizers and pesticides. In view of this, it is extremely important to develop a system of fertilization and crop protection based on biological products. According to the results of the study of biological products, the prospects of their use on agricultural crops for plant protection, optimization of their nutrition and maintenance of soil fertility were noted [6].

When studying the development and substantiation of crop cultivation technologies in organic production, the following important aspects were identified: creation of crop varieties and hybrids resistant to damage, provision of farms with seeds of high reproductive quality of organic origin; development of scientifically based plant fertilization systems to preserve and restore soil fertility, crop rotation and tillage, pest, disease and weed control systems and the use of growth regulators in accordance with the natural and climatic conditions of the regions of Ukraine [5].

In this context, the introduction of a comprehensive approach to assessing the current agro-ecological state of agricultural land is a very important and appropriate basis for developing scientifically sound recommendations for the rational and environmentally sound use of agricultural land.

Conclusions. Thus, the transition to organic farming is accompanied by a reduction in the negative impact on the environment by preventing land degradation, preserving and restoring its natural fertility.

After analyzing scientific research on organic farming conducted in European countries, leading Ukrainian agricultural scientists concluded that there is every reason to believe that the prospects for organic farming are obvious and that Ukraine has

undoubted capabilities in the production and export of organic agricultural products. At the same time, the experience of organic farming accumulated in European countries requires careful study and adaptation to the soil, economic and social characteristics of Ukraine [7].

Organic food production is an efficient and effective way to guarantee consumer safety and quality. The most effective way to control the quality of food is the HACCP system, which allows monitoring all the elementary links of its production. This safety system is based on the analysis of potential threats and their prevention during the entire food production process. To implement it in a business, you need to know the raw materials, products and technological processes, and of course, focus on the factors that can threaten the health of people who consume it.

The HACCP system, unlike other product safety and quality management systems, prevents problems during the production process, rather than when a non-compliance is detected at the stage of the finished product.

The application of HACCP is divided into two stages: basic principles and certification. The system has a positive effect at each stage of its implementation. Certification is the logical conclusion.

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